Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/DK04/000930

International filing date: 30 December 2004 (30.12.2004)

Document type: Certified copy of priority document

Document details: Country/Office: DK
Number: PA 2003 01955
Filing date: 30 December 2003 (30.12.2003)

Date of receipt at the International Bureau: 11 February 2005 (11.02.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

Kongeriget Danmark

Patent application No.: PA 2003 01955

Date of filing: 30 December 2003

Applicant:
(Name and address)

PP Energy Aps
Solsikkevej 3
Havnbjerg
DK-6430 Nordborg
Denmark

Titlel: Devise for enabling access to a structure above ground level such as a wind turbine

IPC: -

This is to certify that the attached documents are exact copies of the above mentioned patent application as originally filed.

Patent- og Varemærkestyrelsen • Kongeriget Danmark •

Patent- og Varemærkestyrelsen
Økonomi- og Erhvervsministeriet

03 February 2005

Pia Høybye-Olsen

PATENT- OG VAREMÆRKESTYRELSEN

DEVICE FOR ENABLING ACCESS TO A STRUCTURE ABOVE GROUND LEVEL SUCH AS A WIND TURBINE

Field of the invention

The present invention relates to a device for enabling access to a structure above ground level, e.g. of considerable height such as a wind turbine, a rotor blade or a tower of such a wind turbine, said device comprising a part that may be lowered and/or lifted in relation to said structure.

Background of the invention

Within the field of wind turbines it is necessary to perform work on parts that is situated at a considerable height above ground level (or sea level, when sea wind turbines are concerned) such as e.g. repair of rotor blades, the surface of these, surface treatment of rotor blades and the tower etc. Further, it has been recognized that it is advantageous or even necessary to clean such parts and in particular the rotor blades in order to maintain good results as regards the power efficiency. Further, it may be advantageous to perform other forms of maintenance in order to achieve good power production results and optimal economic results, such as e.g. surface treatments, inspection etc.

In order to perform such work a number of hoisting arrangements have been proposed in the prior art.

Such a hoisting arrangement is known from German utility model DE 296 03 278 U in which suspension means are fastened to each of the two rotor blades near the hub of the rotor once the windmill has been brought to a stop and with one rotor blade pointing straight downwards. A special work platform with a through-going slit at

the bottom has been fixed to these suspension means so that the rotor blade pointing downwards could be inserted into this slit. The work platform has subsequently been hoisted upwards in a stepwise manner, while the crew has rinsed the surface of the rotor blade manually, e.g. with one person located on each side of the rotor blade.

Even with such an arrangement, it is a time-consuming process to carry out a cleaning of the rotor blades of a windmill, just as such a known arrangement would probably require the use of machinery, such as a crane, for fixation of the suspension means. Further, the platform itself will have a considerable weight and size, thereby leading to further costs and use of heavy machinery for lifting and lowering the platform.

Devices of corresponding kind are known from DE 199 09 698 A1 and DE 43 39 638 A1, which are encumbered with the same disadvantages as those mentioned above, including that extensive use must be made of special material such as cranes, for example mobile cranes, or relatively comprehensive materials which, for example, are mounted on the turbine tower beforehand.

Further, these prior art systems are generally not configured in a manner facilitating user-friendliness and do not provide the personnel with an optimal safety environment.

Thus, it is an objective of the invention to provide an improved device for performing such work at a structure such as a wind turbine, e.g. on a rotor blade or on a wind turbine tower.

It is a further objective to provide such a device whereby improved user-friendliness and safety may be achieved.

A further objective is it to provide such a device that allows access to virtually all parts of e.g. a rotor blade with relatively simple and few means.

It is also an objective to provide such a device that may be designed as a relatively light structure and in relatively light materials while maintaining safety standards and even provide improvements in safety aspects.

These and other objectives are achieved by the invention as explained in detail in the following.

Summary of the invention

The invention relates to a device for enabling access to a structure above ground level, e.g. of considerable height such as a wind turbine, a rotor blade or a tower of such a wind turbine, said device comprising a part that may be lowered and/or lifted in relation to said structure, wherein said device comprises

- a first main part that is suspended by the structure, and
- a second main part that comprises means for carrying a person and that is rotatably connected to said first main part.

Hereby is achieved an arrangement by means of which the user may be able to reach or access all parts of the surface of e.g. a rotor blade of a wind turbine, since the second part is rotated in relation to the first part in order to reach a desired location.

The device according to the invention carrying one or more persons may be located in any vertical position along e.g. a wind turbine rotor blade or tower, preferably controlled by a person at the device, e.g. by controlling the length of the means, e.g. wires suspending the first main part or by climbing up or down such suspending means. Further, the means for carrying a person may be controlled to rotate

preferably within a full revolution, i.e. 360° or even more around the structure, e.g. the wind turbine rotor blade or tower and to be stopped at any position, preferably also controlled by a person at the device.

Thus, a large and heavy platform is avoided, since a person using the device according to the invention may be located at virtually any desired position in relation to the structure, e.g. a wind turbine rotor blade or tower. Hereby the necessary work may be performed using a relatively light construction. Further the safety standard is enhanced since a person using the device according to the invention may be secured in a reliable and dependable manner and since such a person need not move around on a platform that may e.g. be swerving under the influence of the wind and which may be slippery in moist conditions.

Further, it is noted that such a device may be configured to be lowered and lifted by means of hoisting apparatus placed outside the device, e.g. on the wind turbine, on anchoring means and/or at the ground, e.g. on a vessel or at a vehicle, whereby a pull is exerted by means of wires, lines, etc., possibly over pulleys etc. placed on the wind turbine. Instead, the device may be configured to be lowered and lifted by means of hoisting apparatus placed at the device, whereby the device will be able to operate independent of e.g. a support vessel or a vehicle on the ground.

Preferably, as stated in claim 2, said device may comprise a counterweight located essentially opposite said means for carrying a person. Hereby it is achieved that a state of balance will be inherent in the system, adding to the safety and user friendliness of the device according to the invention.

In a further preferable form, as characterized in claim 3, said second main part may comprise a counterweight located essentially opposite said means for carrying a person. Hereby it is achieved that the balance of the system is maintained in a simple manner as the counterweight moves with the person or persons using the device.

According to a further preferable embodiment as characterized in claim 4, said means for carrying a person are adjustable in relation to said second main part. Hereby it will be possible for the user(s) not only to rotate the two parts in order to reach a desired position, but also to displace the platform, the seat etc. in relation to the second main part. Hereby the flexibility is enhanced.

According to a still further preferable embodiment as characterized in claim 5, said means for carrying a person may be displaced linearly and/or rotatably in relation to said second main part. Hereby the user will in an effortless manner be able to reach any part of the surface without regard to the distance from the second part to the surface in question.

In an advantageous form, as characterized in claim 6, said means for carrying a person may be connected to said second main part by means of at least one linkage or connection that provides a rotatable connection. Hereby the displacement in relation to the second part may be achieved in a particular simple and efficient manner.

Advantageously, as characterized in claim 7, said device, e.g. said first main part may be suspended by wires, lines or the like from anchoring means.

According to a particularly preferable embodiment as characterized in claim 8, said counterweight may be designed to be controlled in dependence on the position of said means for carrying a person. Hereby the balance of the system will be maintained even when the means for carrying a person is displaced in relation to the second part, e.g. towards the centre of the circular parts.

Advantageously, as characterized in claim 9, said means for carrying a person may comprise a work platform for one or more persons.

Preferably, as stated in claim 10, said means for carrying a person may comprise seating for one or possibly more persons. Hereby the device may be designed in a particular straightforward manner using a minimum of material and the person using it may enjoin an effortless use of the device while still being subjected to an optimal safety standard since the person will be fastened to the seat using belts, safety harness etc.

Advantageously, as characterized in claim 11, said device and in particular said means for carrying a person may comprise control means for controlling the position of said means, e.g. the height, the angular position, the position in relation to an axis etc. Hereby, the person or the persons using the device may control the device and in particular their own position, e.g. work position in relation to e.g. the surface of a rotor blade, in an optimal manner.

In a particular advantageous form, as characterized in claim 12, said first main part and/or second main part may comprise a frame that may be essentially circular in shape.

According to a further preferable form, as characterized in claim 13, said first main part and second main part may comprise a roller suspension for providing said rotatable connection. Hereby the rotational movement between the two main parts may be achieved in a particular advantageous and reliable manner. Obviously, said roller suspensions may be configured in numerous manners and in suitable numbers, e.g. two, three four or more.

Preferably, as stated in claim 14, the device may comprise anchoring means for fastening to said structure. Such anchoring means may be pre-established or may be established particularly for the purpose of supporting the device.

According to a further preferred form, as stated in claim 15, the device may comprise elevation means for lifting and/or lowering of the device, said elevation means comprising wires or the like connected to said structure, e.g. to anchoring means on said structure.

Preferably, said elevation means comprises two or more such wires or the like, e.g. three, four, five etc., whereby also safety aspects are improved as well as stability etc.

Further, it is noted that elevation means in the form or wires or the like may be used for lifting and/or lowering the device according to the invention by pulling the device by means located at the wind turbine or at the ground, e.g. located at a vehicle or at a vessel.

Preferably, as stated in claim 16, the device may comprise power means, e.g. electric motors, hydraulic and/or pneumatic means for lifting, lowering and/or displacing said parts.

Hereby the device will be able to lift and/or lower itself without power assistance from e.g. a hoist located at a vehicle or a vessel. Thus, the device will be able to operate independently, e.g. without concern for power assistance from other devices. This further enhances safe operation since accidents caused by a power failure at a ground vehicle or a vessel are prohibited. Particularly when operation at sea is concerned, e.g. at sea wind turbines, such an independent configuration is preferable since a support vessel may be unstable, e.g. subjected to waves, current, wind etc. Thus, an arrangement at sea where a vessel provides the elevation by e.g. hoist(s) located on the vessel is prone to accidents and malfunction, and therefore a device as characterized in claim 16 is advantageous not only in general but especially at sea.

Further, it is noted that even when power supply to such a device is subjected to failure, e.g. when electric power is cut off, a device according to the invention will be able to be manually operated, e.g. to be hoisted to the ground and will in general present a safe work tool for all involved, in particular persons occupying the device.

According to a further preferred form as characterized in claim 17, the device may comprise means for lifting and/or lowering anchoring means in relation to said structure. Hereby it will be possible to establish suitable anchoring using the device according to this embodiment, since e.g. the means for lifting and/or lowering anchoring means may be used for climbing up the structure using e.g. a relatively thin wire hanging from or lowered from the structure, until said means reaches a desired and suitable level where it establishes an anchoring location which is secure for suspending the first and the second main part of the device including the person or persons carried by the second main part.

According to a still further preferred form as characterized in claim 18, said means for lifting and/or lowering anchoring means in relation to said structure may comprise means for elevating using a wire or the like connected to a part of said structure, e.g. said wind turbine.

Still further, as stated in claim 19, said device may be adapted for performing inspection, work, repair, surface treatment etc on a rotor blade of a wind turbine.

Also, as stated in claim 20, said device may be adapted for performing inspection, work, repair, surface treatment etc on a tower structure of a wind turbine.

It will be understood that numerous tasks may be performed using the device according to the invention.

Figures

The invention will be described in detail in the following with reference to the drawings, in which

fig. 1 illustrates a wind turbine with a device according to an embodiment of the invention,

fig. 2a shows in a larger scale part of fig. 1 showing the device in a detailed view,

fig. 2b shows corresponding to fig. 2a another embodiment according to the invention,

fig. 2c illustrates, corresponding to fig. 1 a wind turbine with a device according to an embodiment of the invention seen from another angle,

fig. 2d shows corresponding to fig. 2a and 2b an embodiment of the device according to the invention,

fig. 3 is a device according to an embodiment of the invention in further detail,

fig. 4 shows another embodiment of the device according to the invention,

fig. 5 shows a wind turbine from the side with anchoring means in accordance with a further embodiment of the invention,

fig. 6 shows in a larger scale part of fig. 5 showing the anchoring means in a detailed view,

fig. 7 shows corresponding to fig. 5 anchoring means for anchoring at the tower, and

fig. 8 shows in a larger scale part of fig. 7 showing the anchoring means in a detailed view.

Detailed description

Figure 1 illustrates a wind turbine 1 having a tower 2, a nacelle 3 and three rotor blades 4. The wind turbine has been stopped with one of the rotor blades pointing

essentially downwards and a service device 10 according to an embodiment of the invention has been hoisted up along the rotor blade 4. As it will be explained in further detail later on, the service device 10 is connected to anchoring means generally designated 20 by means of lines, wires etc. The anchoring means may be in the form of a locking device that grips a part of the wind turbine, e.g. the root of the rotor blade 4. Further, such a locking device may be an integral part of and/or may be lifted to the desired level by means of an uplift device, e.g. comprising a part lighter than air. Such lifting and/or locking devices that do not form part of the present invention may be of the kind described in PCT/DK03/00577. It will be understood that such a lighter-than-air device may be guided by means of wires 21 connected to the ground, to a vehicle or to a vessel. However, other means of anchoring and/or establishing and/or placing anchoring means may be used as well.

The service device 10 will be explained in further detail with reference to fig. 2a that shows an enlarged detail view corresponding to fig.1. Thus, the anchoring/lifting device 20 is indicated locked to the rotor blade 4 and carrying the service device 10 by means of wires or the like 18, for example three, four etc. such wires uniformly distributed around the circumference of the service device 10. The service device comprises essentially two main parts, e.g. a first main part 12 and a second main part 14.

The first main part 12 may as shown be in the form of a generally circular part that is suspended by the abovementioned wires 18 that may be attached to brackets 19. The first main part 12 may be constructed using tubes, rods etc. of aluminium, composite materials, plastic material, fibre reinforced materials etc. It will be understood that the first main part 12 can be lifted and/or lowered in relation to the anchoring means 20 and the rotor blade 4 by means of the wires or lines 18, e.g. by hoisting means (not shown). Such hoisting means may be placed at the device itself, e.g. at the first main part, whereby the device may hoist itself, e.g. climb up and down the wires, at

the anchoring means or at the ground, e.g. at a vehicle or at a vessel, whereby the hoisting means will elevate the device by e.g. pulling the lines or wires.

The second main part 14 may have a form similar to the form of the first main part and may also be constructed using tubes, rods etc. The second mains part is connected to the first main part 12 in such a manner that the second main part 14 may be rotated in relation to the first main part 12. The two main parts may be connected to each other at suitable locations along the circumference, e.g. at locations corresponding to the locations of the brackets 19. Here, bearings may be arranged and further means of performing a rotational action, e.g. electric motors etc. may be arranged (not shown). The two main parts may thus be mutually rotated, preferably up to a full revolution. i.e. 360° or even more, possibly only limited by electric wires, cables etc. connecting the two parts.

Further, the second main part 14 suspends or carries a work platform 16, e.g. a basket, a cage, a stand etc. for carrying one or more persons that have to perform some sort of work at the wind turbine, e.g. inspection, cleaning, repair, surface treatment etc. This work platform 16 is suspended by means of an arrangement 15 allowing e.g. multidirectional displacement in relation to the second main part 14, as will be explained in further detail later on and whereby virtually any desired position may be taken by the platform 16, e.g. in relation to the rotor blade or another part of the wind turbine.

Further on, the second main part 14 suspends a counterweight body by means of a suspension arrangement 17, which will also be explained in further detail later on. However, the counterweight body is suspended and controlled in such a manner that it is moved in correspondence with the movements of the work platform, whereby a perfect balance is achieved.

Fig. 2b shows an enlarged detailed view corresponding to a further embodiment of the invention. This embodiment corresponds to the one described with reference to fig. 2a, but instead of a work platform this embodiment comprises a seating or a chair 16' for one person only or possibly two or even more persons. It will be understood that such seating will comprise means for securing a person, e.g. seat belt(s) etc. and further means for controlling the position of the chair 16', e.g a joy stick or simular means for controlling the vertical position, the position in relation to the rotor blade (the rotational position) and the distance to the rotor blade. As explained above, the device comprises a counterweight body suspended by means of an arrangement 17 that provides a balancing of the device.

Fig. 2c shows a wind turbine with a service device according to the invention corresponding to fig. 1, but seen from another side. Fig. 2d shows similarly an enlarged detailed view seen from this angle, showing the abovementioned counterweight body 13 suspended by the arrangement 17 from the second main part 14.

Fig. 3 and 4 show in more detail and in schematic manner service devices according to embodiments of the invention, the device shown in fig. 3 comprising a work platform as described above with reference to fig. 2a and the device shown in fig. 4 comprising a seating arrangement as described above with reference to fig. 2b. Apart from this the two illustrated devices are similar.

The first 12 and the second 14 main parts are illustrated as similar essentially circular parts, but it will be understood that other forms may be utilized. The first main part 12 is situated below the second main part 14 and is designed with a number, e.g. four, of brackets 19 for suspending the device from an anchoring means placed on a wind turbine. The brackets 19 may be means for attaching wires (not shown) etc.

The second main part 14 comprises a number of means for suspending this part in relation to the first part 12. Four of these means are utilized in figs. 3 and 4, but it will be understood that other numbers may be utilized, e.g. two, three, five, etc. These means may as illustrated comprise e.g. a number of bolts 32 connected to the second main part, each one carrying wheels or similar means 34 having an outer shape corresponding to the shape of (a part of) the first main part 12. In this manner the two main parts will be connected to each other in a secure manner while still allowing mutual rotational movement that may be up to 360° or more. It will be understood that driving means (not shown) may be connected to one or more of said wheels whereby the rotational action can be made available. Further, it will be understood that the two main parts 12 and 14 may be located differently in relation to each other, e.g. located in the same vertical level or the second part below the first part.

The work platform 16 is as described above suspended by an suspension arrangement 15 that is connected to the second main part, e.g. at the same location as one of the set of wheels 34 or at another location. This suspension arrangement 15 is able to adjust the location of the platform, e.g. by providing rotational movement at a link 36 and/or at a link 38, controlled by suitable control means such as e.g. handles, levers, switches, a joystick or the like (not shown) placed at the work platform 16. Further it will be understood that the suspension arrangement 17 for the counterweight 13 may be configured in a similar manner and/or with a less degree of manoeuvrability as illustrated.

It will also be understood that the suspension arrangements 15 and 17 may be configured in numerous manners which will be obvious to a person skilled in the art, e.g. using rotational joints, telescopic joints etc.

Figs. 5 to 8 illustrate further uses of a service device according to the invention and in particular different manners of providing anchoring for a device according to the invention.

Fig. 5 shows a wind turbine 1 with tower 2, nacelle 3 and rotor blades 4. A wire or the like 42 is attached to a part of the wind turbine at the top, e.g. extending from the rotor hub, the nacelle 3 or from another part in this area as it is shown in an enlarged views in fig. 6. This wire that may be lowered from the e.g. nacelle or that is hoisted and connected to the e.g. nacelle, serves to bring an anchoring means 44 to the top of the wind turbine 1. This may for example take place by having a carrier device 40 that carries the anchoring means 44 climb the wire 42 or by having the carrier device being hoisted by the wire 42. When the carrier device 40 is at a desired level, the anchoring means is brought to grip and/or establish an anchoring at the wind turbine. As shown in fig. 5 and 6 the anchoring means 44 may establish anchoring at a rotor blade 4, or as shown in fig. 7 and 8 the anchoring means 44 may establish anchoring at the tower of the wind turbine 1. In both cases the anchoring means 44 may serve as anchoring for a service device or the like as described above, e.g. for allowing access to any part of a wind turbine e.g. a rotor blade or the tower, at any place, e.g. at any level and/or at any circumferential spot.

It will be understood that the invention is not limited to the particular examples described above but may be used in connection with a wide variety of applications. Further, it will be understood that the system according to the invention may be designed in a multitude of varieties within the scope of the invention as specified in the claims. Thus, it will also be understood that the elements forming part of the device may be designed in numerous manners, as it will be evident to a person skilled in the art. Further, it is also noted that the device according to the invention may be equipped with means not illustrated in the drawings, such as e.g. cables and electric wires for power supply, communication etc. and means for providing

mechanical operation, e.g. hoists, pneumatics, hydraulics etc. which will also be obvious to the skilled person.

5

Reference list

1. Wind turbine
2. Wind turbine tower
3. Nacelle
4. Rotor blade
10. Service device
12. First main part
13. Counterweight
14. Second main part
15. Suspension arrangement
16. Work platform
16'. Seating or chair
17. Suspension arrangement
18. Wires, lines or the like
19. Brackets
20. Anchoring means
21. Wires, lines or the like
32. Bolts
34. Wheels or the like
36. Linkage
38. Linkage
40. Carrier device
42. Wire
44. Anchoring means

Patent Claims

1. Device for enabling access to a structure above ground level, e.g. of considerable height such as a wind turbine, a rotor blade or a tower of such a wind turbine, said device comprising a part that may be lowered and/or lifted in relation to said structure (1), c h a r a c t e r i z e d i n t h a t said device (10) comprises
- a first main part (12) that is suspended by the structure (1), and
- a second main part (14) that comprises means (16, 16') for carrying a person and that is rotatably connected to said first main part (12).

2. Device according to claim 1, c h a r a c t e r i z e d i n t h a t said device (10) comprises a counterweight (13) located essentially opposite said means (16, 16') for carrying a person

3. Device according to claim 1 or 2, c h a r a c t e r i z e d i n t h a t said second main part (14) comprises a counterweight (13) located essentially opposite said means (16, 16') for carrying a person.

4. Device according to claim 1, 2 or 3, c h a r a c t e r i z e d i n t h a t said means (16, 16') for carrying a person are adjustable in relation to said second main part (14).

5. Device according to claim 4, c h a r a c t e r i z e d i n t h a t said means (16, 16') for carrying a person can be displaced linearly and/or rotatably in relation to said second main part (14).

6. Device according to claim 4 or 5, c h a r a c t e r i z e d i n t h a t said means (16, 16') for carrying a person is connected to said second main part by means of at least one link that provides a rotatable connection.

7. Device according to one or more of claims 1 to 6, characterized in that said device (10), e.g. said first main part is suspended by wires, lines or the like (18) from anchoring means.

8. Device according to claim 2 or 3, characterized in that said counterweight (13) is designed to be controlled in dependence on the position of said means for carrying a person.

9. Device according to one or more of claims 1 to 8, characterized in that said means for carrying a person comprises a work platform (16) for one or more persons.

10. Device according to one or more of claims 1 to 8, characterized in that said means for carrying a person comprises seating (16') for one or possibly more persons.

11. Device according to one or more of claims 1 to 10, characterized in that said device and in particular said means (16, 16') for carrying a person comprises control means for controlling the position of said means, e.g. the height, the angular position, the position in relation to an axis etc.

12. Device according to one or more of claims 1 to 11, characterized in that said first main part (12) and/or second main part (14) comprises a frame that may be essentially circular in shape.

13. Device according to one or more of claims 1 to 12, characterized in that said first main part (12) and second main part (14) comprises a roller suspension (34) for providing said rotatable connection.

14. Device according to one or more of claims 1 to 13, c h a r a c t e r i z e d i n t h a t the device comprises anchoring means (20, 44) for fastening to said structure (1).

15. Device according to one or more of claims 1 to 14, c h a r a c t e r i z e d i n t h a t the device comprises elevation means for lifting and/or lowering of the device, said elevation means comprising wires or the like (18) connected to said structure (1), e.g. to anchoring means (20, 44) on said structure.

16. Device according to one or more of claims 1 to 15, c h a r a c t e r i z e d i n t h a t the device comprises power means, e.g. electric motors, hydraulic and/or pneumatic means for lifting, lowering and/or displacing said parts.

17. Device according to one or more of claims 1 to 16, c h a r a c t e r i z e d i n t h a t the device comprises means for lifting and/or lowering anchoring means (20, 44) in relation to said structure.

18. Device according to one or more of claims 1 to 17, c h a r a c t e r i z e d i n t h a t said means for lifting and/or lowering anchoring means (20, 44) in relation to said structure comprises means (40) for elevating using a wire (42) or the like connected to a part of said structure, e.g. said wind turbine.

19. Device according to one or more of claims 1 to 18, c h a r a c t e r i z e d i n t h a t said device is adapted for performing inspection, work, repair, surface treatment etc on a rotor blade of a wind turbine.

20. Device according to one or more of claims 1 to 18, c h a r a c t e r i z e d i n t h a t said device is adapted for performing inspection, work, repair, surface treatment etc on a tower structure of a wind turbine.

Abstract

Device for enabling access to a structure above ground level, e.g. a structure of considerable height such as a wind turbine, a rotor blade or a tower of such a wind turbine. The device comprises a part that may be lowered and/or lifted in relation to said structure (1). The device (10) comprises a first main part (12) that is suspended by the structure (1), and a second main part (14) that comprises means (16, 16') for carrying a person and that is rotatably connected to said first main part (12).

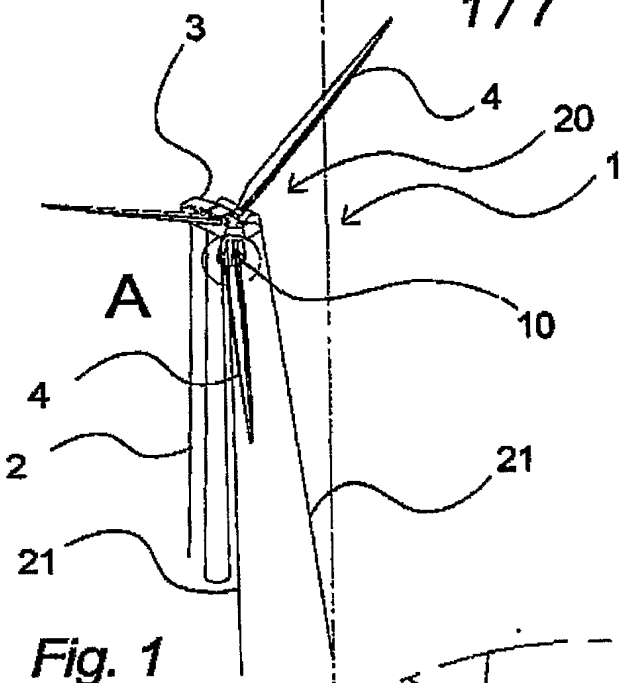


Fig. 1

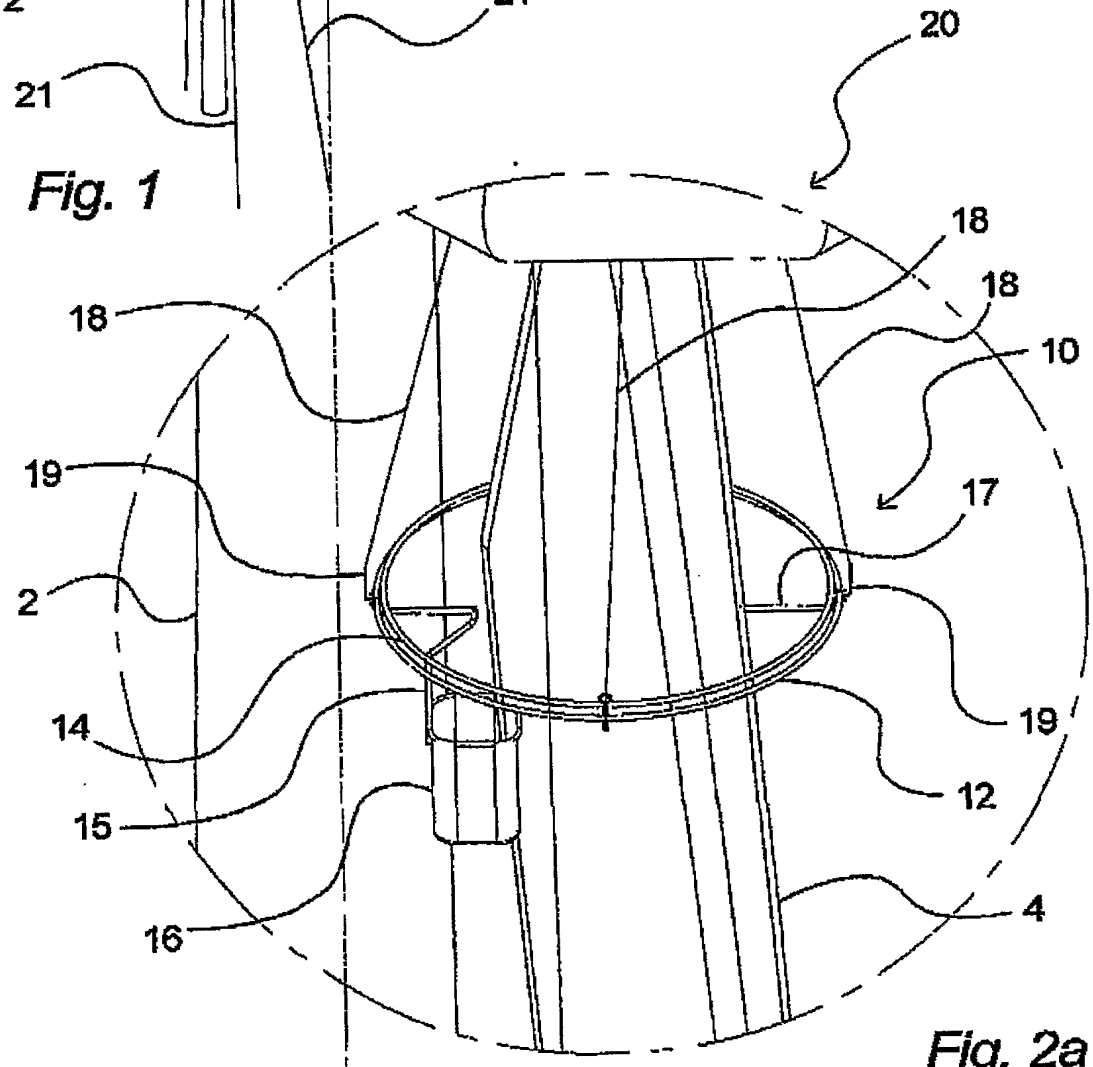
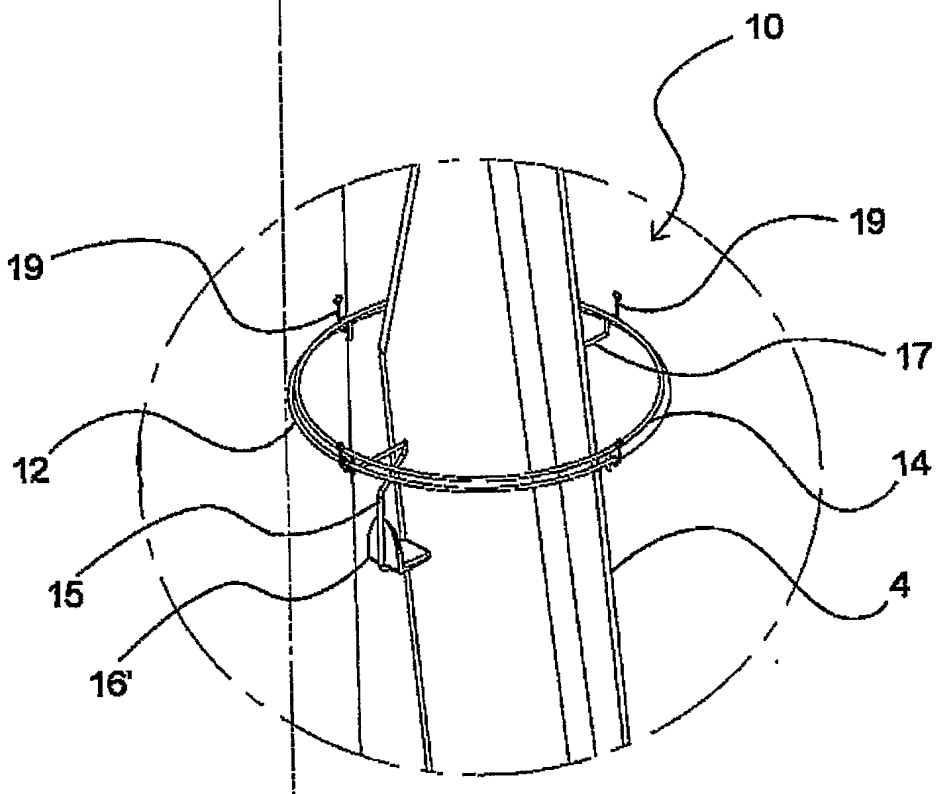


Fig. 2a

DETAIL A



DETAIL A

Fig. 2b

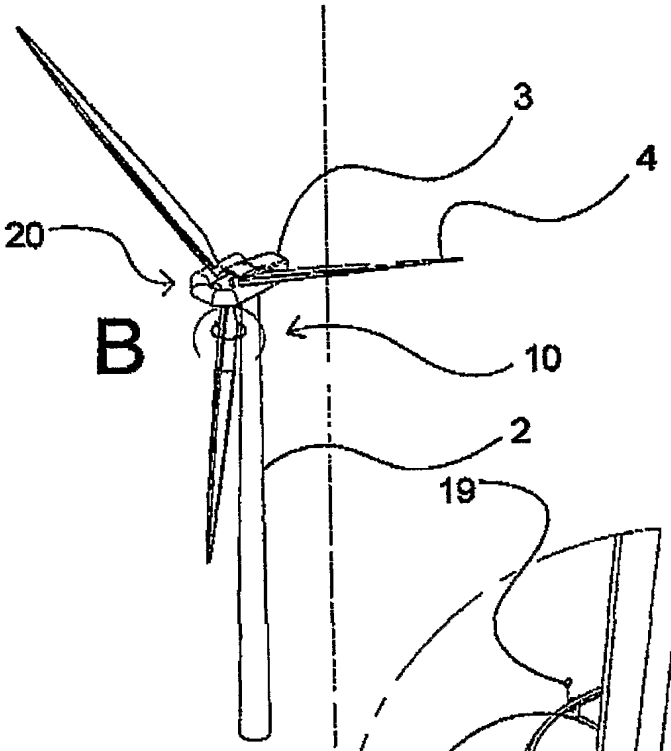
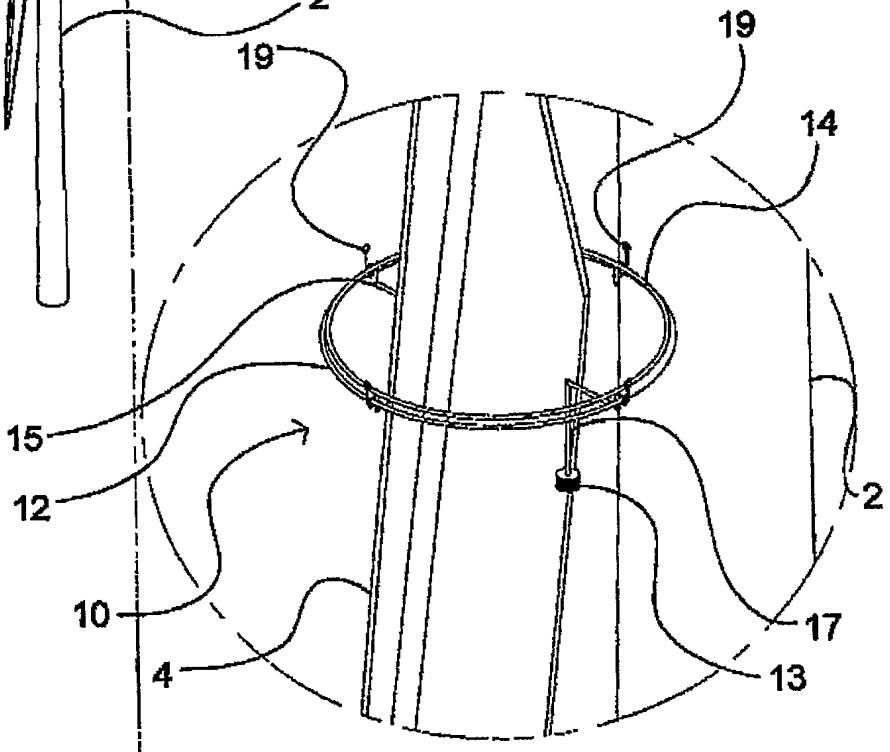


Fig. 2c



DETAIL B

Fig. 2d

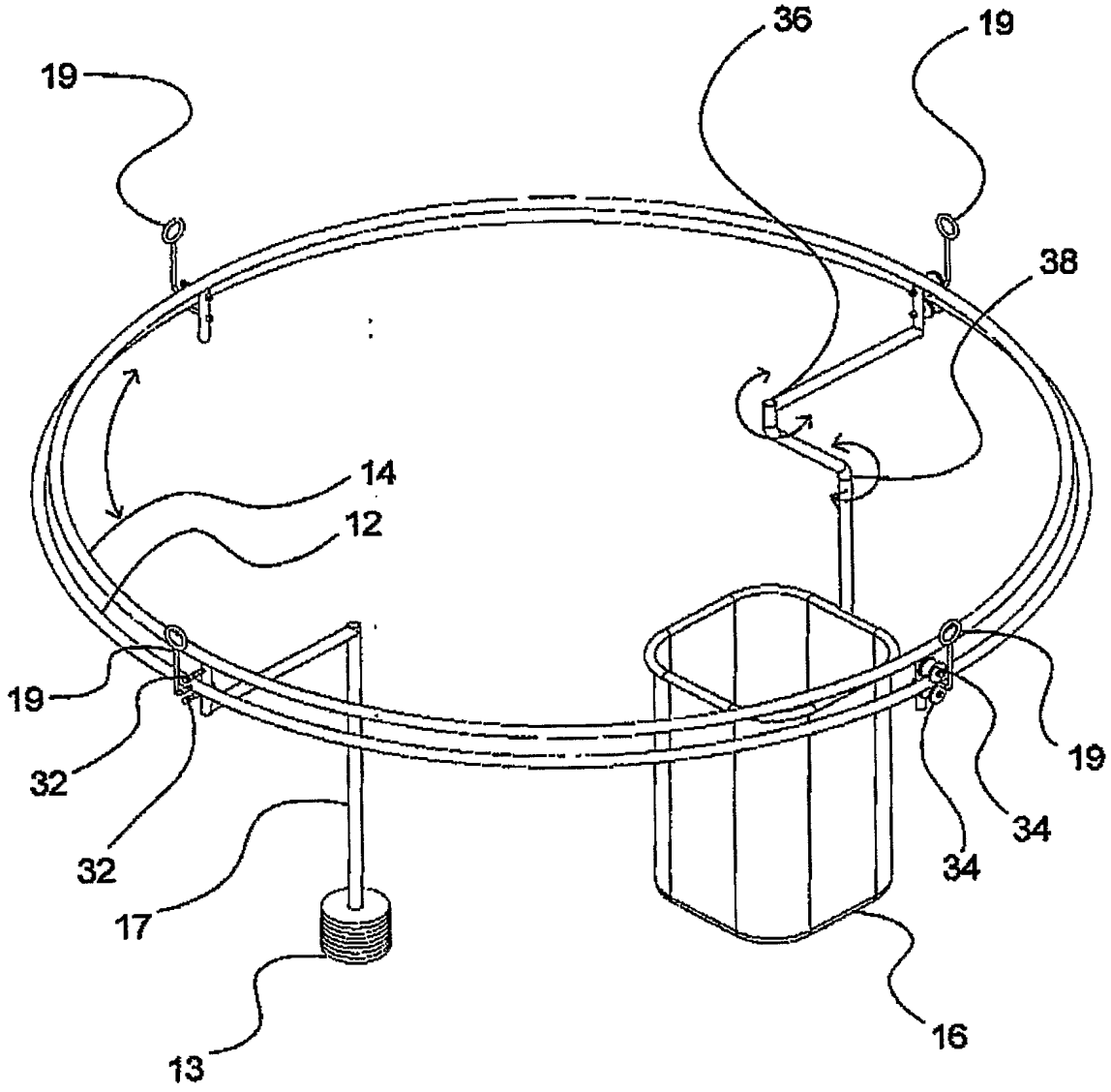


Fig. 3

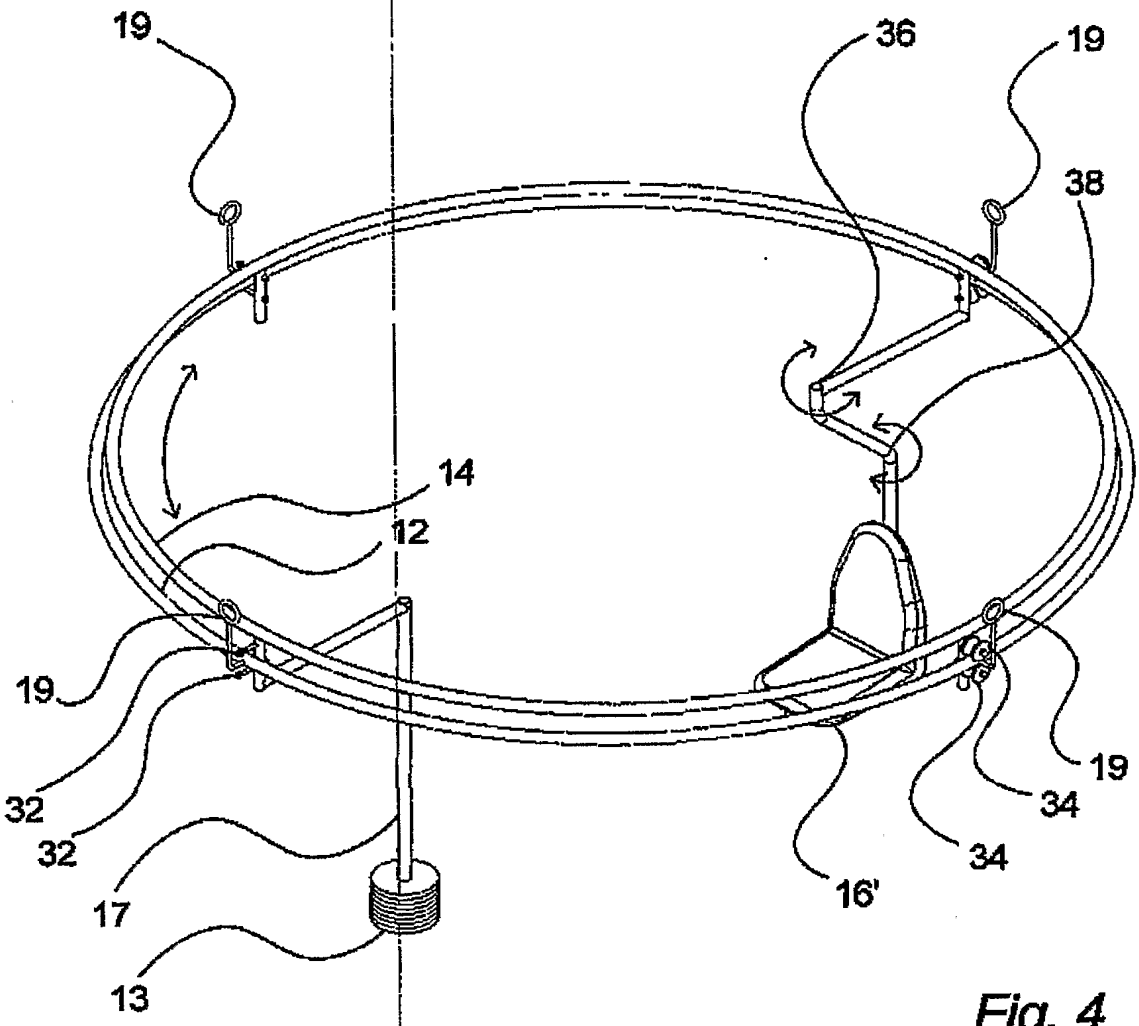


Fig. 4

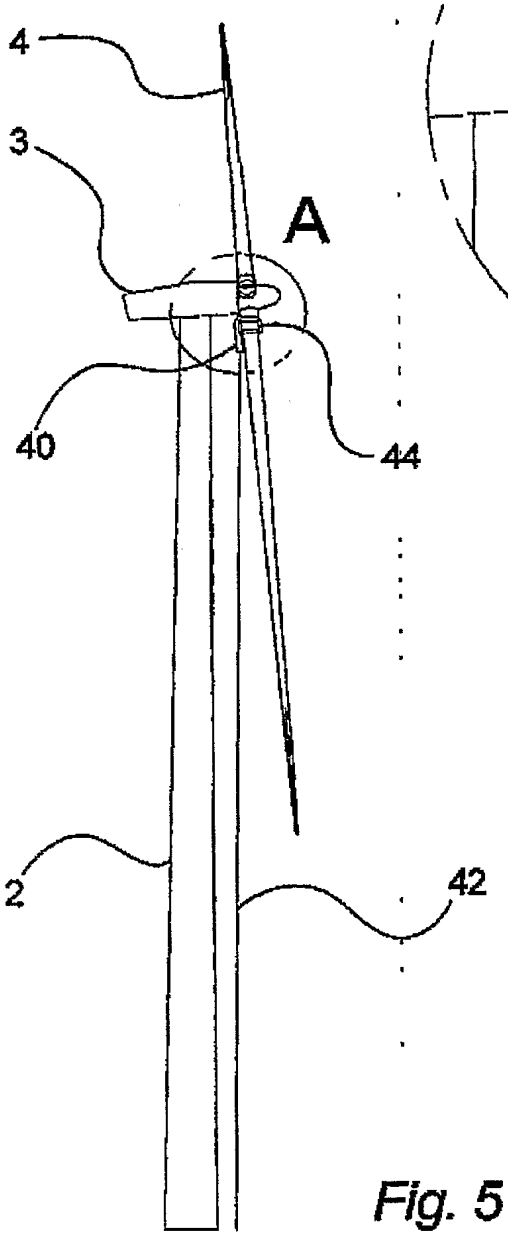


Fig. 5

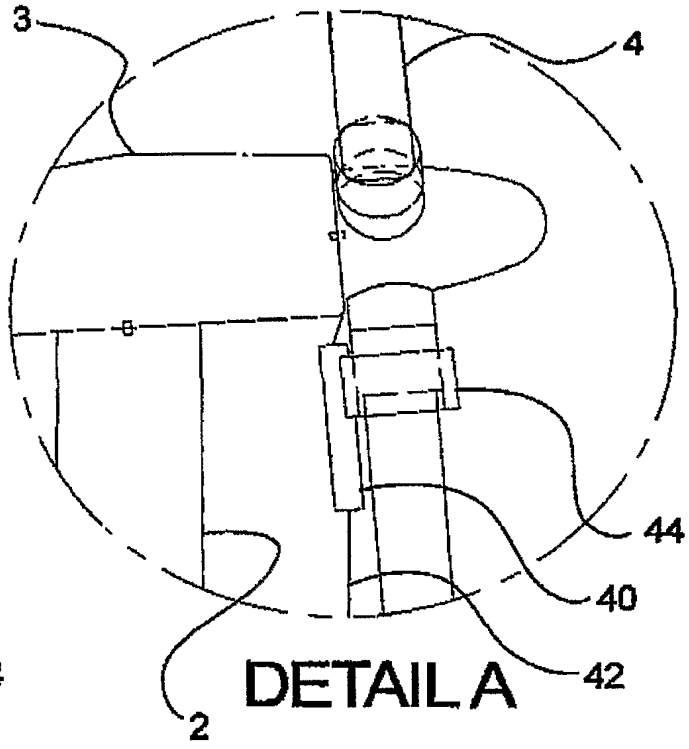


Fig. 6

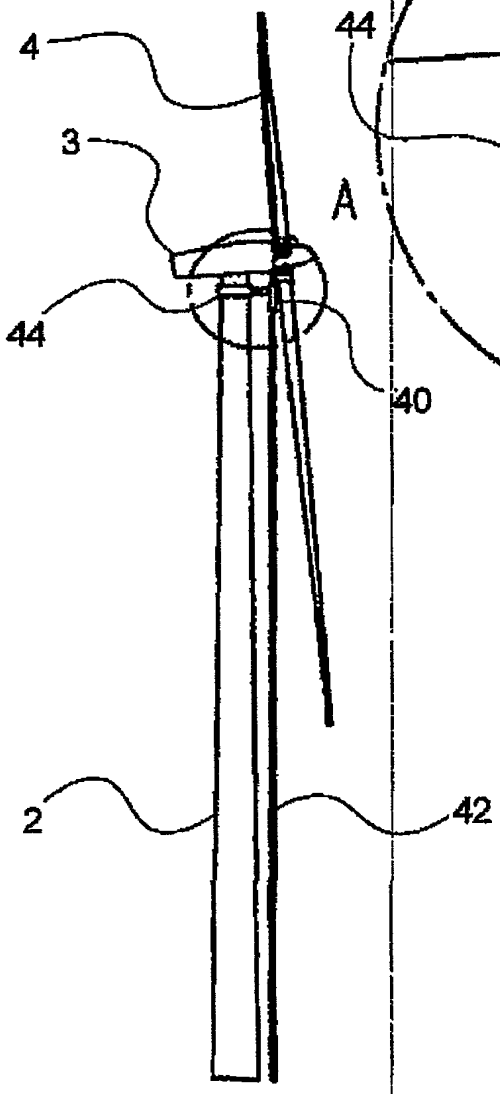


Fig. 7

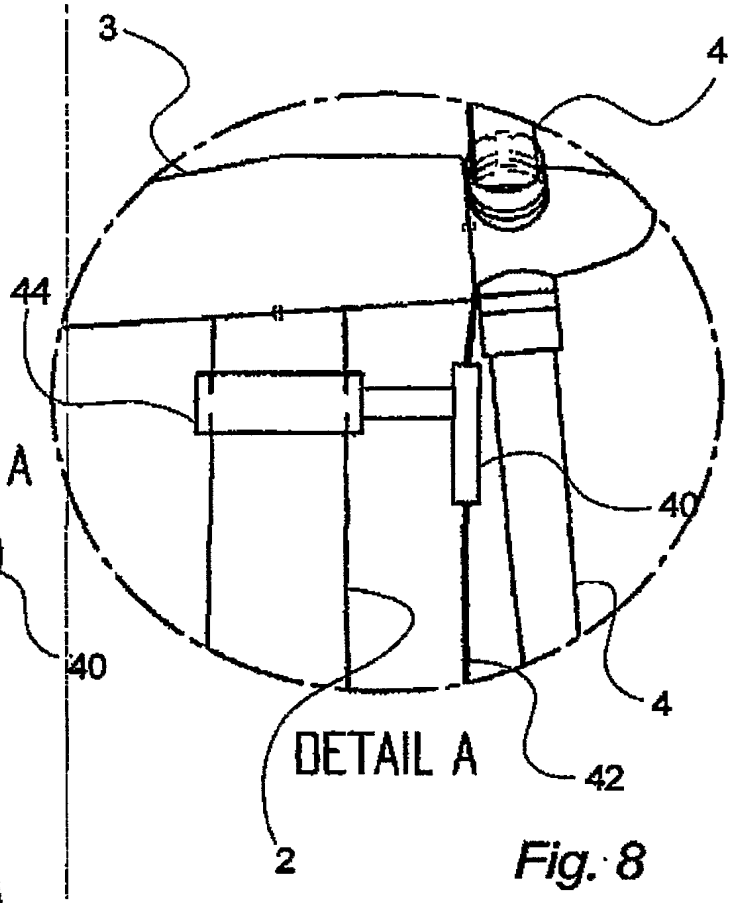


Fig. 8